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ABSTRACT

The present study explores accuracy and speed of responses by the five-year-old child to expanded and conjoined sentences. The following factors were considered: (a) number of transformations, (b) types of transformations, (c) auxiliary-type sentence expansion and (d) type of query (those designed to elicit responses which should reflect comprehension of syntax versus those designed to elicit responses which should reflect comprehension of sentence meaning). Subjects were kindergartners from the American English speech community of Los Angeles. Since psycholinguistic literature suggested that number of transformations might reflect comprehension difficulty, the conjoined sentences used in the experiment were arranged according to the number of operations or transformations they exhibited. Results of the experiment showed, however, that number of transformations was not a useful predictor of the speed or accuracy of the child's responses to the types of sentences used. Sentence expansion was also not considered significant. Transformation type seemed to be pertinent to locating problem areas of difficulty in sentence comprehension, but it was not clear to what extent generalizations regarding this factor could be drawn from the data derived from the present study. This document was previously announced as ED 043 002. (Author/FWB)

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The Five-Year-Old's Comprehension of Expanded and Transformed Conjoined Sentences

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THE FIVE-YEAR-OLD'S COMPREHENSION OF EXPANDED AND TRANSFORMED CONJOINED SENTENCES

Evelyn Hatch, Jeffrey Sheff, Diana Chastain

Language studies using children as Ss tend to be of two types: (a) those in which structures are elicited to test the child's production of rules of grammar, and (b) those where non-verbal responses to structures are elicited to test his comprehension of structures. While rule production responses (Berko, 1958) are subject to linguistic performance factors, comprehension response studies (Luria, 1959; Gleitman, et al 1966; Olds, 1968) attempt to get at linguistic competence by observing behavioral responses to the sentence stimulus. The child is not required to produce the sentence himself.

A number of these studies either predicate hypotheses upon or discuss results in terms of transformational grammar. Thus, Klima & Bellugi (1967) described a child's grammar in the form of phrase structure base rules plus a number of transformations. Dennis (in Loban, 1964) analyzed the oral production of two children over a six year period from age six, noting types and number of transformations used. Menyuk (1964) analyzed approximations to grammatical sentences produced by three-year-olds according to whether the utterance "error" was at the "kernel sentence" level, the transformational level, or at the morphological level. Dennis and Menyuk drew parallel conclusions about the child's language ability from their work: (a) The child's ability to produce grammatical sentences at the transformationally complex level indicates greater control of language structures than consistent creation of grammatical sentences at the kernel sentence level, and (b) Quantity and variety of transformations reinforce one another, so that the child with greater control over language produces not just more transformed sentences but a wider range of transformation types.

The conclusions drawn by Dennis and by Menyuk appear consistent with those of earlier literature testing the "psychological reality" of transformation grammar.

Miller (1962) suggested that, given human memory limitations, an utterance must be recoded into some simplified form in order to be stored and understood. This simplified form of the utterance was its underlying kernel form plus a number of rules, or transformations, which, once applied to the kernel, would reproduce the original form. Transformations (the rule operations) were seen as analogous to mental work units. From this view stems the hypothesis that difficulty of processing an utterance is directly proportional to the number of transformations necessary to reduce the utterance to its underlying kernel form.

A number of studies using adult Ss have sought to evaluate the Miller hypothesis (Miller & McKean, 1964; Mehler, 1963; Gough, 1966; Savin & Perchonock, 1965). The findings lend support to but do not unequivocally establish the notion that transformational rules are representative of mental operations. Four lines of argument regarding such studies and their findings may be discerned.

First, a study by Hepler (1967) suggested that number of transformations per se could not be used as predictor regarding the correctness or latency of responses.

Second, if number of transformations is indeed one of the critical factors underlying prediction of sentence difficulty, it clearly is not a sufficient factor. A number of studies have cited non-transformational factors to account for the fact that utterances with the same number of transformations are not always processed with equal difficulty. (Slobin, 1966; Gough, 1966; Clark & Clark, 1968).

Third, many of the transformation rules are not one-step rules. The method for determining the number of operations involved in a transformation or set of transformations remains unclear. For example, the transformation to change a sentence structure such as that exemplified by "Stuart Little is a mouse" to the yes-no question, "Is Stuart Little a mouse?" counts as one operation. If that is true, then does the Wh-question "What is Stuart Little?" also count as one transformation, even though the Wh-question form calls for additional operations (deleting "a mouse" from the yes-no question form after it is copied in the Wh-question form, plus extraposing [as "What"] to sentence-initial position)?

Finally, the format of the grammar itself has changed since the earlier studies were done. The concept of the kernel sentence with of a number of transformations applied to it no longer is applicable except as a heuristic.

The present study explores accuracy and speed of responses by the 5-year-old child to sentences exemplifying secondary conjunction. The

following factors were considered: (a) number of transformations, (b) type(s) of transformation, (c) auxiliary-type sentence expansion, and (d) type of query--those eliciting responses which should reflect comprehension of syntax versus those eliciting responses which should reflect extralinguistic competence (comprehension of sentence meaning).

METHOD

Subjects. Serving as subjects were 160 5-year-old prereaders from the American English speech community of Los Angeles County. Each S was tested individually in a single 10-minute session.

Materials. The 16 sentence types illustrating conjoined sentences which were used in the study are illustrated in Table 1. The sentences are all variants of the conjoined sentence Subject-Verb-Object + Subject-Verb-Object. The Subject-Verb-Object form was chosen since it is thought to be the most commonly used sentence pattern of Kindergarten children (O'Donnell, et al 1967). The area of linguistic interest in each case is the second clause, since it is here that the transformation occurs. Therefore, it is here that any comprehension difficulty of the syntax should occur. The sentences can be described according to the changes in number of operations or transformations that the second clause undergoes, as follows:

Operations.

1. conjunction
   "John ate a sandwich and Mary ate a hotdog."

2. conjunction + verb deletion
   "John ate a sandwich and Mary a hotdog."

   conjunction + neg
   "John didn't eat a sandwich and Mary didn't eat a hotdog."

3. conjunction + object deletion + do replacement
   "John didn't eat a sandwich but Mary did."

   conjunction + verb deletion + neg
   "John didn't eat a sandwich nor Mary a hotdog."

4. conjunction + object deletion + do replacement + neg
   "John ate a sandwich but Mary didn't."
   "John didn't eat a sandwich nor did Mary."

   conjunction + object deletion + do replacement + so/too
   "John ate a sandwich and so did Mary."
   "John ate a sandwich and Mary did too."

Table 1

Sentence Comprehension Study 1: Stimulus Characteristics

Degree of Expansion	Transformation	Stimulus Number	Stimulus
None	$Conj_{and}$	A1	John ate a sandwich and Mary ate a hotdog.
None	$Conj_{and}$ + Del_V	A2	John ate a sandwich and Mary a hotdog.
None	$Conj_{and}$ + Neg	B1	John didn't eat a sandwich and Mary didn't eat a hotdog.
None	$Conj_{or}$ + Neg + Del_V	B2	John didn't eat a sandwich nor Mary a hotdog.
None	$Conj_{but}$ + Del_0 + do	C1	John didn't eat a sandwich but Mary did.
None	$Conj_{but}$ + Del_0 + do + Neg	C2	John ate a sandwich but Mary didn't.
None	$Conj_{and}$ + Del_0 + do + <u>too</u>/so	D1	John ate a sandwich and Mary did too.
None	$Conj_{and}$ + Del_0 + do + too/<u>so</u>	D2	John ate a sandwich and so did Mary.
None	$Conj_{and}$ + Del_0 + do + Neg + <u>ei</u>/nei	E1	John didn't eat a sandwich and Mary didn't either.
None	$Conj_{and}$ + Del_0 + do + Neg + <u>ei</u>/nei	E2	John didn't eat a sandwich and neither did Mary
Aux	See D1	F1	John had to eat a sandwich and Mary did too.
Aux	See D2	F2	John had to eat a sandwich and so did Mary.
Aux	See E1	G1	John didn't have to eat a sandwich and Mary didn't either.
Aux	See E2	G2	John didn't have to eat a sandwich and neither did Mary.
None	$Conj_{and}$ + do + Neg + <u>ei</u>/nei + Pro	H1	John didn't eat a sandwich and Mary didn't eat one either.
None	$Conj_{or}$ + Del_0 + do + Neg	H2	John didn't eat a sandwich nor did Mary.

5. conjunction + object deletion + do replacement + neg + either
"John didn't eat a sandwich and neither did Mary."
"John didn't eat a sandwich and Mary didn't either."

conjunction + do replacement + neg + either + Pro obj replacement
"John didn't eat a sandwich and Mary didn't eat one either."

Twenty topical variants of each of 16 sentence types shown in Table 1 were used. Vocabulary was taken from the Rinsland (1945) list and checked at Levels 1 and 2 of the list of Dale, et al (1963). The A_1 versions of these 20 sets are presented in Table 2. The A_1 version was then rewritten for all 16 sentence types of Table 1. The content words of the 16 sentence types thus obtained do not vary across the materials sample.

Design. The first member of each of the A-H pairs illustrated in Table 1; will be denoted P_1; the second, P_2. Two types of query were used: (a) Q_1--"What did Subject 2 do?"--which queried understanding of a transformation and (b) Q_2--"Tell me about Subject 1 and Subject 2"--which queried understanding of the sentence.

Ss were assigned in the order of release from their classroom to one of eight groups (A through H, corresponding to the sentence pair code of Table 1) and to one of two presentation orders--O_1 or O_2. Each S responded to four sets of "sentence + query" stimuli, each set containing five stimuli. Sets were as follows: P_1Q_1, P_1Q_2, P_2Q_1, P_2Q_2. Sets by orders are presented in Table 3. Half the Ss responded to 20 stimuli in one order; half in the other.

Procedure. Prior to testing, each S was given a short training session to provide him with instruction on the nature of the task required and to help him adapt to the experimental situation (see appendix). Materials for the training session were selected to shape the S to attend to the questions to be used. Feedback as to the correctness of each response was given in the practice period only. Using this procedure, it was possible to attune the great majority of the Ss to the task. Failure to properly answer the practice sentences was the criterion for excluding a subject from the testing procedure. Using this criterion, four subjects were excluded. Four additional subjects were excluded from the data compilation for speech impediments or for non-English phonology (that is, Spanish phonology). One subject had to leave the room during the session.

During the testing session, the E presented each stimulus sentence and the query. If any part of the sentence was misread, she stopped and started the sentence over again. Sentence intonation was standardized. After the question, if the S did not answer within approximately 10 seconds, the E presented the next sentence. During the session, the E noted any unusual occurrences or behavior of the S in response to the test sentences, and she rated the correctness of the answers given.

Table 2
Versions of A_1 Sentence Type

1. Father put on a shoe and the teacher put on a hat.
2. Mary found a bicycle and Betty found a dollar.
3. Bobby ate an egg and Mary ate some bread.
4. The girl played a drum and the boy played the piano.
5. Grandma bought a chair and mother bought a table.
6. The baby took a cup and mama took a bowl.
7. Mary washed a wagon and Bobby washed the bicycle.
8. The teacher found a pencil and the child found the chalk.
9. John opened a basket and Mary opened the box.
10. The girl patted a rabbit and the boy patted the horse.
11. John carried a broom and Billy carried the box.
12. Billy watched a bird and Sally watched a kite.
13. The cowboy chased a bear and the hunter chased a lion.
14. The rat ate a cookie and the mouse ate the bread.
15. John fixed the fence and Bill fixed the house.
16. The milkman bought a car and the farmer bought a boat.
17. Jane went to church and Betty went to the store.
18. Daddy caught a snake and brother caught a butterfly.
19. Grandma made lunch and father made coffee.
20. Sister pushed the lamp and Grandpa pushed the chair.

Table 3

Stimulus Sets and Orders

Sentence Number	P_1PQ	O_2PQ
1	11	12
2	22	21
3	21	22
4	12	11
5	22	21
6	11	12
7	21	22
8	12	11
9	21	22
10	12	11
11	22	21
12	11	12
13	12	11
14	21	22
15	11	12
16	22	21
17	21	22
18	12	11
19	11	12
20	22	21

Both stimulus and S's response were recorded on tape. While data were taken directly from the tape for scoring, remarks noted by the E were also taken into account. It was found that the training and testing session took approximately 10 minutes per S with a brief pause of less than a minute between practice and test sessions

Scoring. Latency and accuracy measures were obtained for each response. Each accurate response was given a value of 1. Since each S received five sentences for each condition for his group, his score ranged from 0 to 5 (proportion correct - 0, .2, .4, .6, .8, 1) for each condition. Latencies were measured to the nearest tenth second from the tape recording, and the average latency for correct responses under each condition was recorded for each subject.

RESULTS AND DISCUSSION

Number of transformations. Since the literature suggested that number of transformations might reflect comprehension difficulty, the sentence types were arranged according to number of operations (ranging from 1 to 5). Mean correct responses for each of these five levels (Table 4) suggest that number of operations or transformations per se is not a useful measure of stimulus difficulty. In fact, for the responses sought by "Tell me about Subject 1 and Subject 2" (Q_2), Ss performed best on 5-scale transformation sentences and responded more quickly to them than to 1 or 2-scale types. It appears unlikely then that number of operations alone tells us much about sentence difficulty.

TRANSFORMATION TYPES

Negation

It was expected that sentences involving negation would elicit fewer correct responses than affirmative sentences. If, as the studies cited earlier suggested, negative sentences were processed back to affirmative, neg + neg should be much more difficult than pos + pos. The basis for the expectation of difficulty with negative sentences, however, was that it is not clear from such a sentence as "John didn't eat a sandwich" whether negation meant that a) he didn't eat a sandwich but rather a hotdog, b) he didn't eat a sandwich but rather gobbled it, or that c) Mary rather than John ate the sandwich. While stress was controlled in the experiment, confusion could be expected as to the meaning of negation; therefore, fewer accurate responses were expected.

Contrary to expectation, responses to sentence types which were identical except for sentence negation did not differ significantly $p>.05$. (See Table 5, which compares Sentence Types D and F [affirmative] with Types E and G [negative] and Table 6, which compares Sentence Type A

Table 4

Summary Table of Mean Proportion Correct and Geometric Mean Latency

Number of Operations	Sentence Type	Proportion Correct		Latency (Sec.)	
		Q1	Q2	Q1	Q2
1	A1	.88	.34	1.01	1.92
2	A2	.64	.20	1.39	2.13
2	B1	.88	.32	1.06	1.53
3	C1	.82	.47	1.09	1.74
3	B2	.60	.18	1.47	1.72
4	C2	.83	.43	1.10	2.35
4	H2	.80	.69	1.04	.94
4	D1	.93	.74	1.05	1.01
4	D2	.80	.65	1.09	1.05
5	E1	.89	.85	.91	.87
5	E2	.85	.82	.92	.84
5	H1	.94	.85	.91	.96
AUX Expanded	F1	.84	.85	.92	.86
	F2	.74	.81	.96	.88
	G1	.91	.83	.77	.90
	G2	.88	.68	.86	.91

[1]The non-expanded sentence types are ordered by number of transformation operations.

[affirmative] with Type B [negative]).

One might have predicted that responses to Q_1 queries would not be different for affirmative and negative sentences because the question contained the negative "What didn't Subj. 2 do?" If this were the explanation, then responses to Q_2 queries might still have differed, since the question in this case was affirmative--"Tell me about Subj. 1 and Subj. 2." However, the Query x Negation interactions were non-significant, indicating that negation is ineffective for either type of query.

The response Sentence Types F and G were longer than Sentence Types D and E, with increased length effected through expansion. The object was to increase task magnitude without increasing transformational complexity. Expansion effects for Types D and E (nonexpanded) vs Types F and G (expanded) also were nonsignificant, and interpretation of this finding is that the level of expansion employed was not sufficient to achieve a reliable increase in task magnitude.

A significant 3-way interaction involving sentence negation did occur, [$F(1,76) = 10.05$, $p<.01$]. In Q_2, Ss gave more correct responses to expanded affirmative sentences (Group F) than to expanded negative sentences (Group G). This was reversed in Q_1, with slightly better responses to expanded negative sentences (see Table 5). A possible explanation is that length of response required in Q_2 rather than negation itself might be responsible for the interaction. This interaction is discussed in more detail under Sentence Expansion below.

The latency data is presented in Tables 7 and 8. The analysis of variance shows negation to be a non-significant variable. There was, however, a significant interaction ($p<.05$) between negation and response type with sentences A and B, [$F(1,38) = 4.48$]. Ss took longer to respond to the "tell me about" instructions for positive sentences than for negative. There was no significant difference on the correctness measure. While they took longer for positive sentences, the answers given were just as correct for positive as for negative sentence stimuli.

No difference was found between neg + pos and pos + neg sentence sequences ("John didn't watch a bird but Mary did" vs "John watched a bird but Mary didn't"). This was true both on the correctness measure and on the latency measure (see Tables 9 and 10).

Subject-Verb vs Verb-Subject Order

It was expected that sentences using normal subject-verb order would elicit more correct responses than those involving reversed order. That is, sentences using "....and Mary did too," or "....and Bill didn't either," would be easier than "....and so did Mary" or "....and neither did Bill."

Table 5

Mean Proportion Correct Responses,
Sentence Types D, E, F, G.

	1* (normal S-V order)		2 (reversed S-V order)	
	Non-expanded			
	Q1	Q2	Q1	Q2
D (affirmative)	.93	.74	.80	.65
E (negative)	.89	.85	.85	.82
	Expanded			
F (affirmative)	.84	.85	.74	.81
G (negative)	.91	.83	.88	.68

Table 6

Mean Proportion Correct Responses
Sentence Types A, B.

	1 (Verb present)		2 (Verb deleted)	
	Q_1	Q_2	Q_1	Q_2
A (affirmative)	.88	.34	.64	.20
B (negative)	.88	.32	.60	.18

1* Numbers 1 and 2 refer to stimulus number as given in Table 1.

Table 7

Geometric Mean Latency (Sec.),
Sentence Types D, E, F, G.

	1 (normal S-V order)		2 (reverse S-V order)	
	Q_1	Q_2	Q_1	Q2
	Non-expanded			
D (affirmative)	1.05	1.01	1.09	1.05
E (negative)	.91	.87	.92	.84
	Expanded			
F (affirmative)	.92	.86	.96	.88
G (negative)	.77	.90	.86	.91

Table 8

Geometric Mean Latency (Sec.),
Sentence Types A, B.

	1 (verb present)		2 (verb deleted)	
	Q_1	Q_2	Q_1	Q2
A (affirmative)	1.01	1.92	1.39	2.13
B (negative)	1.06	1.53	1.47	1.72

Table 9

Mean Proportion Correct Responses,
Sentence Types C_1, C_2.

	Q_1	Q_2
C_1 (Neg Pos)	.82	.47
C_2 (Pos Neg)	.83	.43

Table 10

Geometric Mean Latency (Sec.)
Sentence Types C_1, C_2.

	Q_1	Q_2
C_1 (Neg Pos)	1.09	1.74
C_2 (Pos Neg)	1.10	2.35

The data are presented in Table 5. The Subject-Verb order variable proved to be statistically significant [$F(1,76) = 24.91$, $p<.01$]. Ss gave consistently more accurate responses to sentences with subject-verb order than to those with verb-subject order:

Subject-Verb	Verb-Subject
....and X did too	....and so did X
....and X didn't either	....and neither did X

Better performance was obtained for subject-verb order both for affirmative and negative sentences; no significant interaction was obtained. Expanding the utterance had no appreciable effect; Ss still responded better to the subject-verb order.

Greater accuracy of subject-verb order responses can be attributed to higher frequency of this order in sentence statements. However, did, the verb form replacement in these examples, probably precedes the subject noun more often (in all yes/no questions and in information questions) than it follows the subject (in emphatic sentences). One might claim that X did too is the transformation and that so did X is an optional alternative transformation applied to X did too and therefore more difficult than the form from which it is obtained.

Sentence vs Constituent Negation

It was expected that sentence negation samples would yield more correct responses than sentences involving constituent negation. That is, sentences including didn't (with neg attached to do) would be easier than sentences where the neg was attached to some other word (in this case, to either as neither, and to the conjunction or as nor). The basis for this expectation was that it is commonly supposed that constituent negation is learned later than sentence negation.

Any difference in Subject-Verb order magnitude effects due specifically to sentence vs constituent negation would have appeared in the interaction between negation and subject-verb order. Since this interaction was not reliable, the difference between the two forms is due solely to the subject-verb order and not to the negative form of the sentence.

It was also found that the "and neither" form of constituent negation did not differ significantly from the "nor" form (see Tables 11 and 12).

Verb Deletion

If one believes in readability measures based primarily on sentence length, one must contend that the shorter the sentence, the greater likelihood of a correct response. If one believes in the

psychological reality of the transformation as a mental word element, one must contend that deletion will make the sentence more difficult.

The deletion data are presented in Table 6. The deletion main effect was statistically significant [$F(1,38) = 37.95$, $p<.01$]. Ss gave fewer correct responses to sentences in which the identical verb had been deleted from the second clause ("John found a nickel and Bill -(found)- a dime."). The poorer performance can be accounted for on the basis of the transformation. Perhaps owing to its greater transformational complexity, the deleted verb structure is less frequently used, both in oral and written English. It is also probable that deletion takes place more frequently in sentences which include both the direct and indirect object than in those with just a direct object. Ss might have responded better to sentences containing deletion if such sentences as "John gave Mary a nickel and Bill a dime" had been used. However, the decision to keep all sentences in the subject + verb + object plus subject + verb + object pattern precluded testing this possibility.

The interaction between deletion and response type was also significant [$F(1,38) = 5.06$, $p<.05$). Deletion yielded less accurate responses to Q_1 than Q_2. It is possible that, since responses were generally poorer on all Q_2 tasks, there is a "floor" effect on Q_2. That is, since Q_2 is already lower, deletion does not have as much chance to lower the scores.

The latency data (Table 8) also show the deletion variable to be statistically significant, [$F(1,38) = 21.49$, $p<.01$]. The latency data do not reflect the deletion-response interaction found in the correctness measure above, lending support to the "floor" effect assumption.

Sentence Expansion

Having considered number of transformations and type of transformation, we next looked at the effect of sentence expansion. In the expanded sentences F and G, the AUX of Clause 1 was expanded to include modal. No additional transformation was involved in the expansion:

Sentence	Expanded Sentence
John ate a sandwich and Mary did too.	John had to eat a sandwich and Mary did too.

This sentence expansion apparently did not change the task load sufficiently to increase response difficulty (see Table 5). It was hoped that once the sentence was expanded, the effects of various transformations would be magnified.

Perhaps one reason for the lack of effect is that "had to", while adding a semantic distinction, added only one stressed syllable to

Table 11

Mean Proportion Correct Responses,
Sentence Types E_2, H_2.

	Q_1	Q_2
E_2 ("and neither")	.85	.82
H_2 ("nor")	.80	.69

Table 12

Geometric Mean Latency (Sec.)
Sentence Types E_2, H_2.

	Q_1	Q_2
E_2 ("and neither")	.92	.84
H_2 ("nor")	1.04	.94

sentence length. Secondly, the query for response 1 contained the "had to" ("What did Subj. 2 have to do?"). It is interesting that most Ss simply ignored the "had to" if they processed it at all. Slobin (1967) and others have commented on this type of phenomenon in imitation task response of younger children. The great majority of Ss in this study did not include "have to" in their responses and such responses were counted as correct. This was more often true in response to Q_1 than in response to Q_2. For example, in response to the sentence "Father didn't have to catch a snake and Bill didn't either," and the instructions "Tell me about father and Bill," the child would reply, "They didn't catch a snake," or "Father and Bill didn't catch a snake," but it may not have been so clear to the child whether or not "had to" also referred to Subj. 2.

Response Type

Two questions were used to elicit responses in the study. The first tested comprehension of the transformations involved. Since the transformations occurred in the second clause of the sentence (A found a Y and so did B, and B did too, but B didn't, etc.), the first response was elicited by the question "What did B (Subject 2) do?" Another query, Q_2, was chosen because it was felt that a) Q_1 contained a question transformation which might be as difficult as any transformation in the stimulus sentence, and b) we were interested in the effect of the transformations on the comprehension of total sentence meaning. Q_2 stated: "Tell me about Subject 1 and Subject 2." We are interested in whether accuracy and speed of response would be parallel to the two queries; that is, whether "difficulty" of the sentence type would be reflected in both responses.

Responses queried by "Tell me about Subj.1 and Subj.2" (Q_2) were consistently more "difficult" (that is, less accurate and slower) than those queried by "What did Subj.2 do?" (Q_1). The difference increased with the length of the answer demanded. The means for Q_1 and Q_2 are given in Tables 5, 6, and 9 for the correctness measure and in Table 10 for the latency measure. Comparison between means in each Table indicated statistically reliable differences, [$F(1,76) = 9.43$, $p<.01$], [$F(1,38) = 126.92$, $p<.01$], [$F(1,76) = 168.4$, $p<.01$], [$F(1,38) = 32.7$, $p<.01$], respectively. Interactions with negation and with deletion have been discussed above. The three-way interaction mentioned above suggests that responses in Q_2 in sentences including "had to" may have been more difficult because semantic information was asked for which could be more easily ignored in responses to Q_1.

Response Measures

Two response measures were selected: correctness and the latency from the end of the query to the beginning of the response. There was a large degree of correspondence between the latency and correctness

measures, each supporting the validity of the other. The major difference appears in the three-way interaction (Table 7) of Expansion x Negative x Response; this interaction was statistically significant for the correctness measure but not for the latency measure.

CONCLUSIONS

The data showed that number of transformations as described was not a useful predictor of speed or accuracy of the kindergarten child's response to sentence samples concerned with secondary conjunction. In looking at types of transformations, the difference between subject-verb orders and the deletion vs non-deletion transformations were statistically significant. However, the difference between affirmative and negative sentence types as well as the difference between sentence and constituent negation did not reach statistical significance.

Hence, while transformation type seems to be pertinent to locating problem areas of difficulty in sentence comprehension, it is not clear how much one can generalize from these data. Reversing subject-verb order increased sentence difficulty for both affirmative and negative sentences. It seems clear that this is the effect of the transformation; however, it is uncertain whether permutation as a process will always cause this difference or if it is only in the case of subject-verb order change. Deletion (shortening the sentence by decreasing redundancy) made the sentence more difficult. Again it is not clear whether the deletion process would always increase the difficulty of the sentence or if it is only in the case where verb redundancy is involved.

Questions involving task magnitude, query types, and response measures were also raised in the study. Sentence expansion was not significant; that is, it did not magnify task difficulty enough to force further differences to appear in the data. In future studies it would be useful to check the number of stressed syllables added rather than just words added to get a more realistic picture of expansion in orally presented material.

Regarding response cues, the "Tell me about $\underline{S_1}$ and $\underline{S_2}$" instruction yielded fewer correct responses and gave a longer latency period than the response cue "What did $\underline{S_2}$ do?" The responses cued by "Tell me about" entered into one interaction with negation in an unpredictable manner, and also, perhaps, caused the three-way interaction with negation and expansion. In all cases it seems to have tested recall more than the area of the transformation. Using both response cues was useful in that the child was never sure until he received the instruction what he would be required to do. This prevented him from listening for one part of the sentence only.

APPENDIX

Instructions

I'm going to say some things to you. Then I'm going to ask you some questions. So you listen carefully. (Read training cards.)

1. Jack ate ice cream.
   What did Jack do?

2. Mary bought a dress.
   What did Mary do?

3. Sally didn't find an apple.
   What didn't Sally do?

4. Bobby opened the door.
   Tell me about Bobby.
   (If the child begins to describe Bobby, stop him by asking "What did I tell you Bobby did?....Bobby opened the door.... tell me about Bobby.")

5. Bill and Jane broke the box.
   Tell me about Bill and Jane.

6. Mary and Mark didn't throw the ball.
   What didn't Mark do?

7. Sam and Bob didn't eat lunch.
   Tell me about Sam and Bob.

You're very good at this game. Did you ever do it before? (Allow child to say whatever he wants at this point.)
Now let's do the rest of these cards. (Continue with test sentences.)

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